FIG. 1

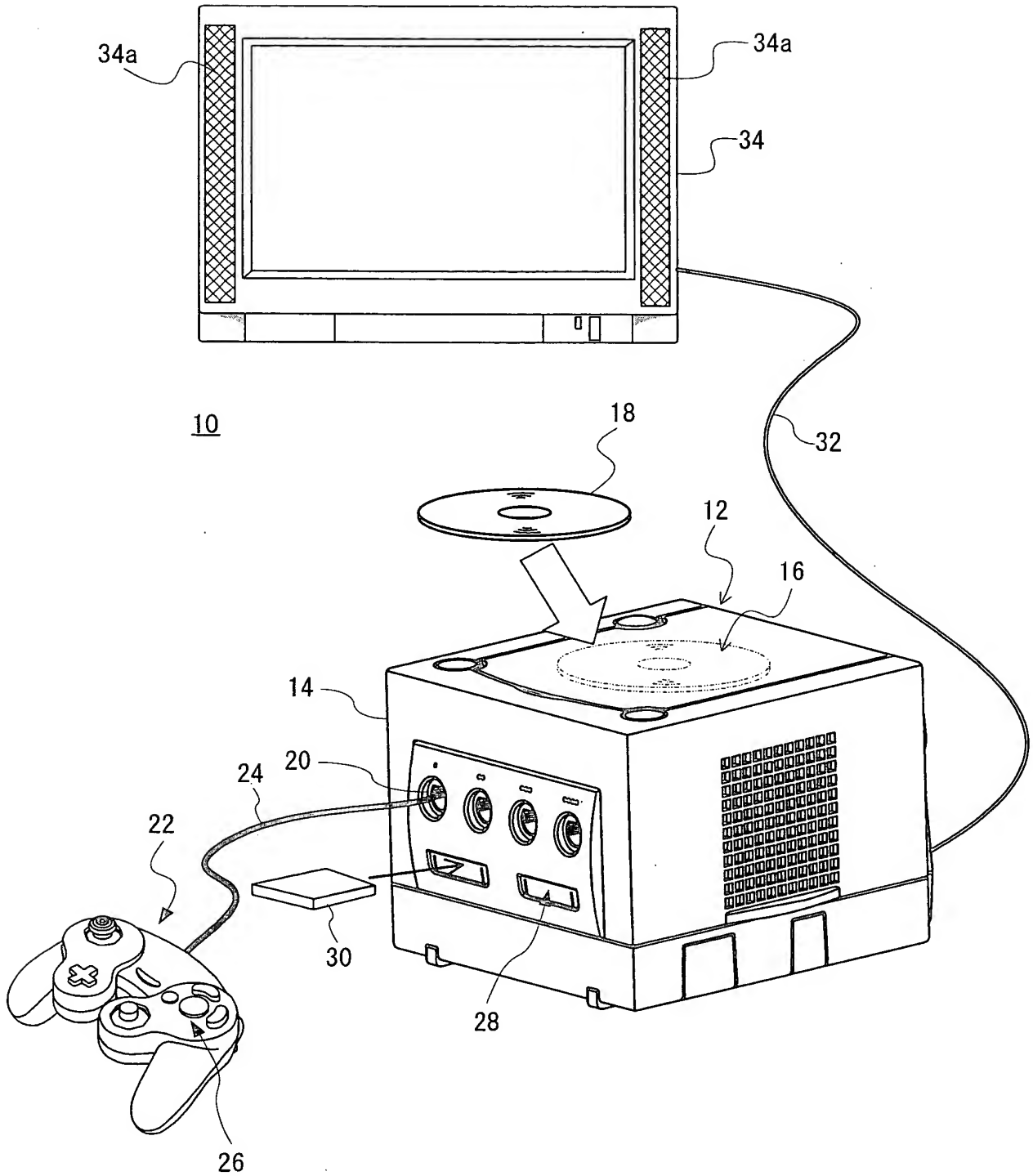


FIG. 2

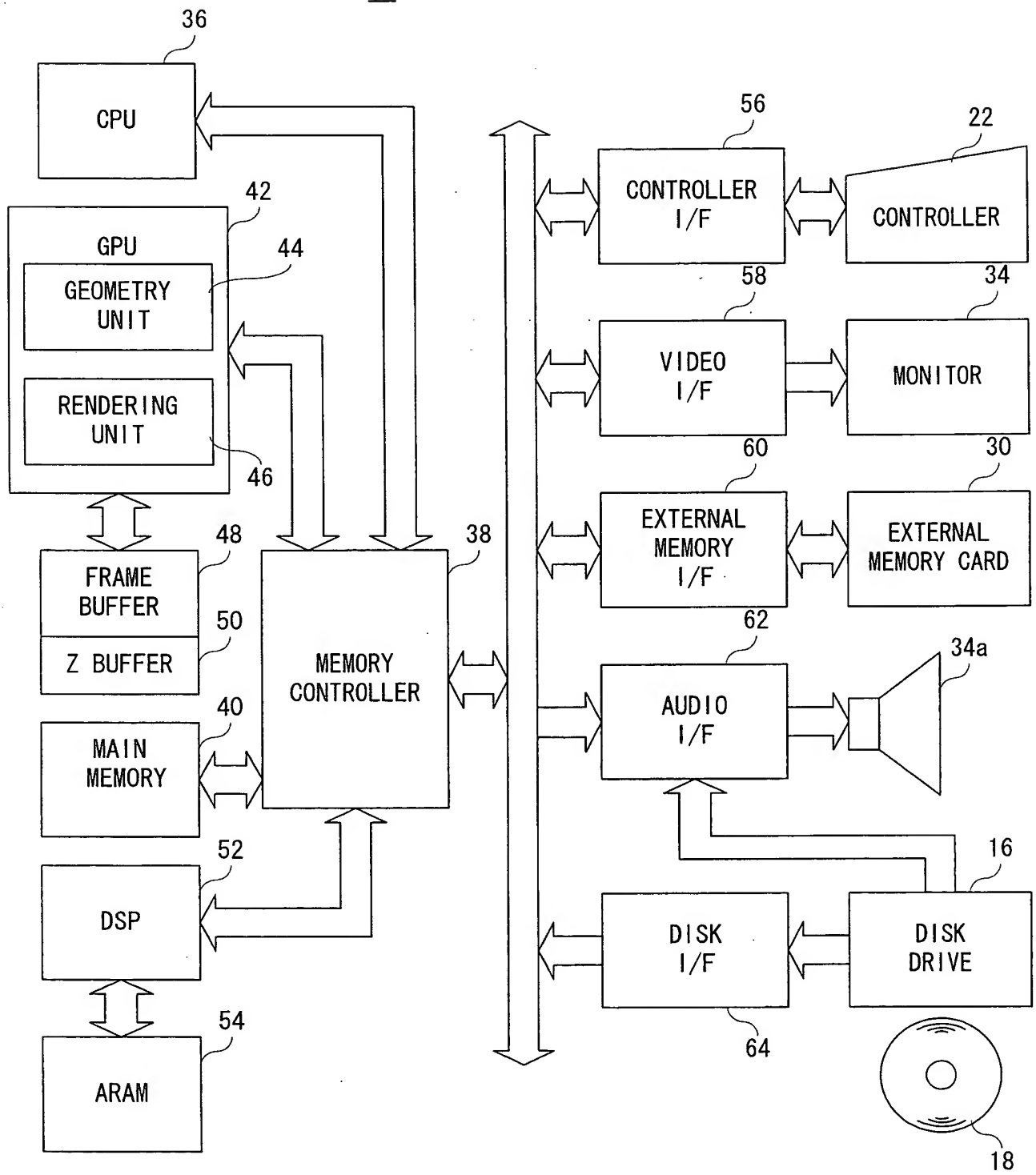

12
36
CPU
42
GPU
44
GEOMETRY UNIT
RENDERING UNIT
46
48
FRAME BUFFER
50
Z BUFFER
38
MEMORY CONTROLLER
40
MAIN MEMORY
52
DSP
54
ARAM
56
CONTROLLER I/F
22
CONTROLLER
58
VIDEO I/F
34
MONITOR
60
EXTERNAL MEMORY I/F
30
EXTERNAL MEMORY CARD
62
AUDIO I/F
34a
16
DISK I/F
DISK DRIVE
64
18

FIG. 3

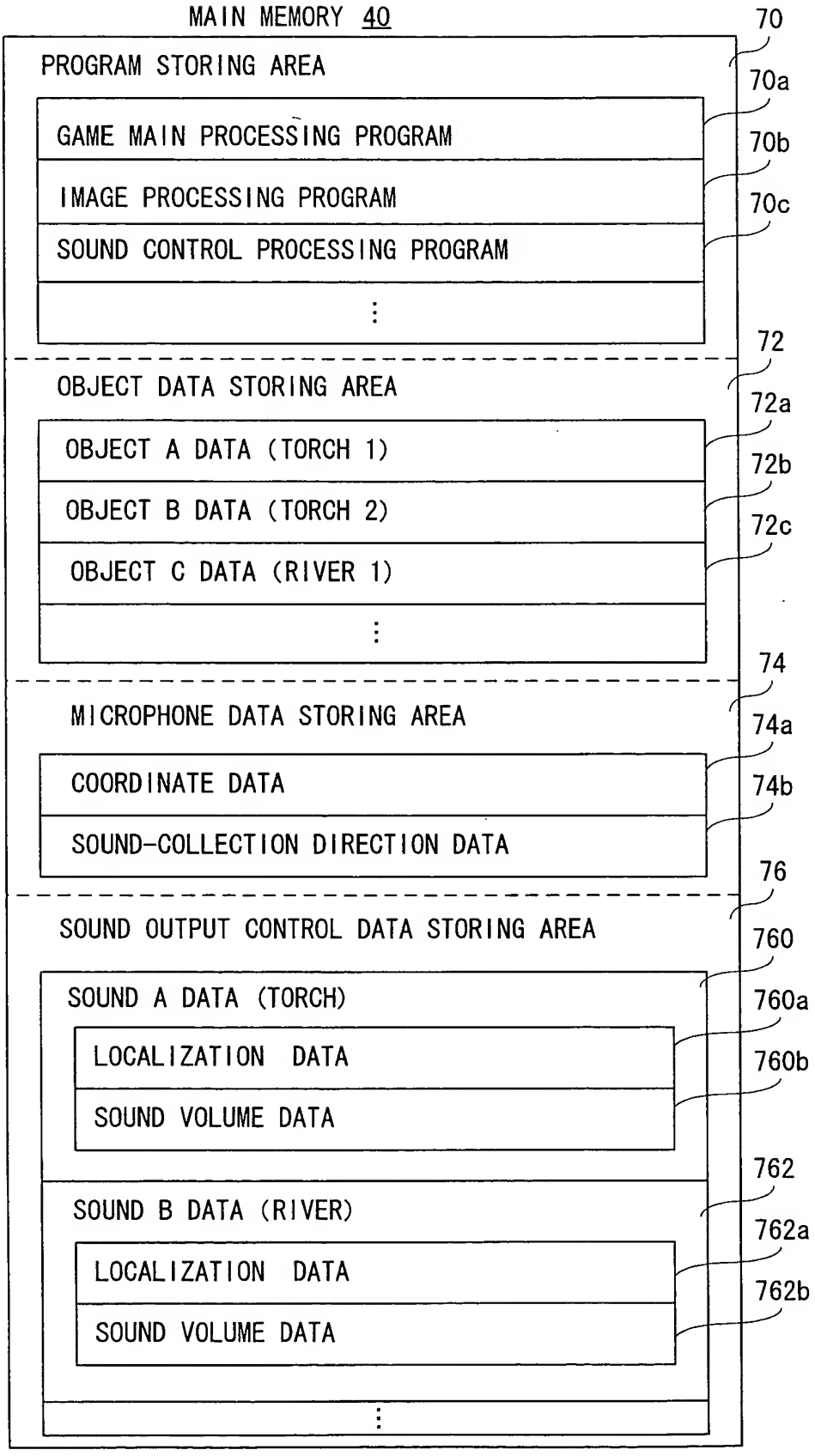

MAIN MEMORY 40
70
PROGRAM STORING AREA
70a
GAME MAIN PROCESSING PROGRAM
70b
IMAGE PROCESSING PROGRAM
70c
SOUND CONTROL PROCESSING PROGRAM
72
OBJECT DATA STORING AREA
72a
OBJECT A DATA (TORCH 1)
72b
OBJECT B DATA (TORCH 2)
72c
OBJECT C DATA (RIVER 1)
74
MICROPHONE DATA STORING AREA
74a
COORDINATE DATA
74b
SOUND-COLLECTION DIRECTION DATA
76
SOUND OUTPUT CONTROL DATA STORING AREA
760
SOUND A DATA (TORCH)
760a
LOCALIZATION DATA
760b
SOUND VOLUME DATA
762
SOUND B DATA (RIVER)
762a
LOCALIZATION DATA
762b
SOUND VOLUME DATA

FIG. 4

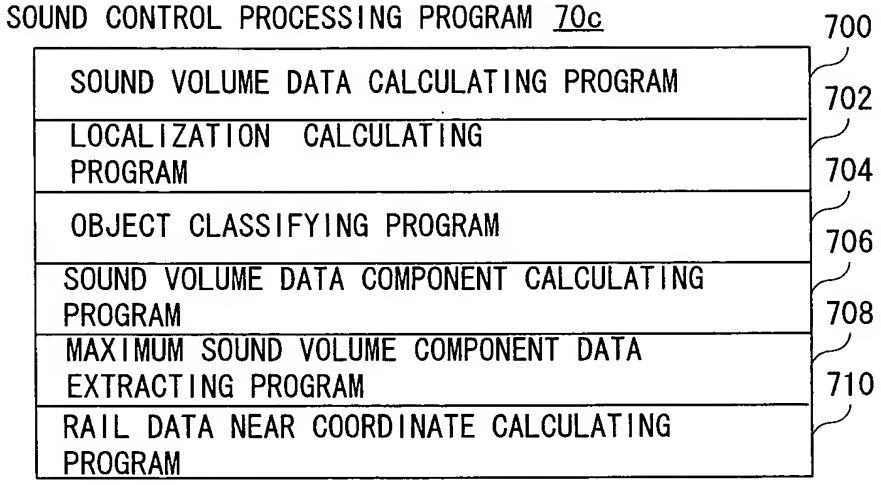

SOUND CONTROL PROCESSING PROGRAM 70c
700
SOUND VOLUME DATA CALCULATING PROGRAM
702
LOCALIZATION CALCULATING PROGRAM
704
OBJECT CLASSIFYING PROGRAM
706
SOUND VOLUME DATA COMPONENT CALCULATING PROGRAM
708
MAXIMUM SOUND VOLUME COMPONENT DATA EXTRACTING PROGRAM
710
RAIL DATA NEAR COORDINATE CALCULATING PROGRAM

FIG. 6

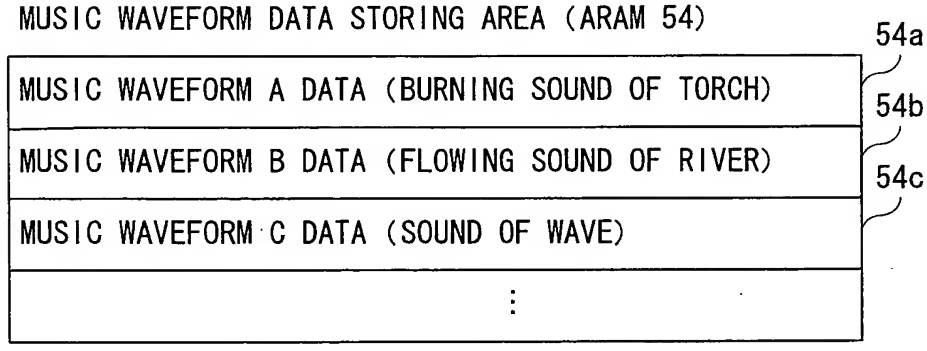

MUSIC WAVEFORM DATA STORING AREA (ARAM 54)
54a
MUSIC WAVEFORM A DATA (BURNING SOUND OF TORCH)
54b
MUSIC WAVEFORM B DATA (FLOWING SOUND OF RIVER)
54c
MUSIC WAVEFORM C DATA (SOUND OF WAVE)
⋮

FIG. 5

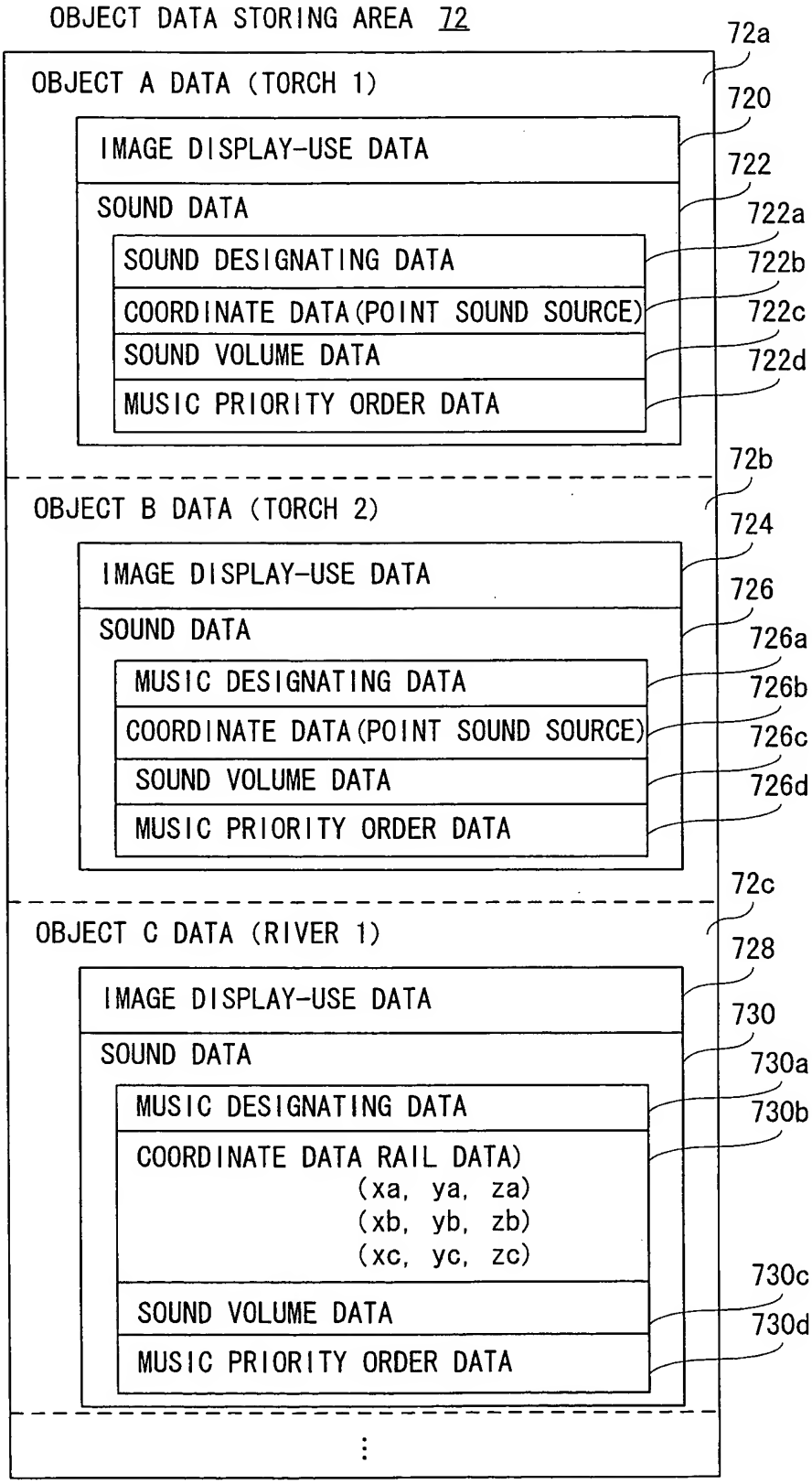

OBJECT DATA STORING AREA 72
72a
OBJECT A DATA (TORCH 1)
720
IMAGE DISPLAY-USE DATA
722
SOUND DATA
722a
SOUND DESIGNATING DATA
722b
COORDINATE DATA(POINT SOUND SOURCE)
722c
SOUND VOLUME DATA
722d
MUSIC PRIORITY ORDER DATA
72b
OBJECT B DATA (TORCH 2)
724
IMAGE DISPLAY-USE DATA
726
SOUND DATA
726a
MUSIC DESIGNATING DATA
726b
COORDINATE DATA(POINT SOUND SOURCE)
726c
SOUND VOLUME DATA
726d
MUSIC PRIORITY ORDER DATA
72c
OBJECT C DATA (RIVER 1)
728
IMAGE DISPLAY-USE DATA
730
SOUND DATA
730a
MUSIC DESIGNATING DATA
730b
COORDINATE DATA RAIL DATA)
(xa, ya, za)
(xb, yb, zb)
(xc, yc, zc)
730c
SOUND VOLUME DATA
730d
MUSIC PRIORITY ORDER DATA

FIG. 7

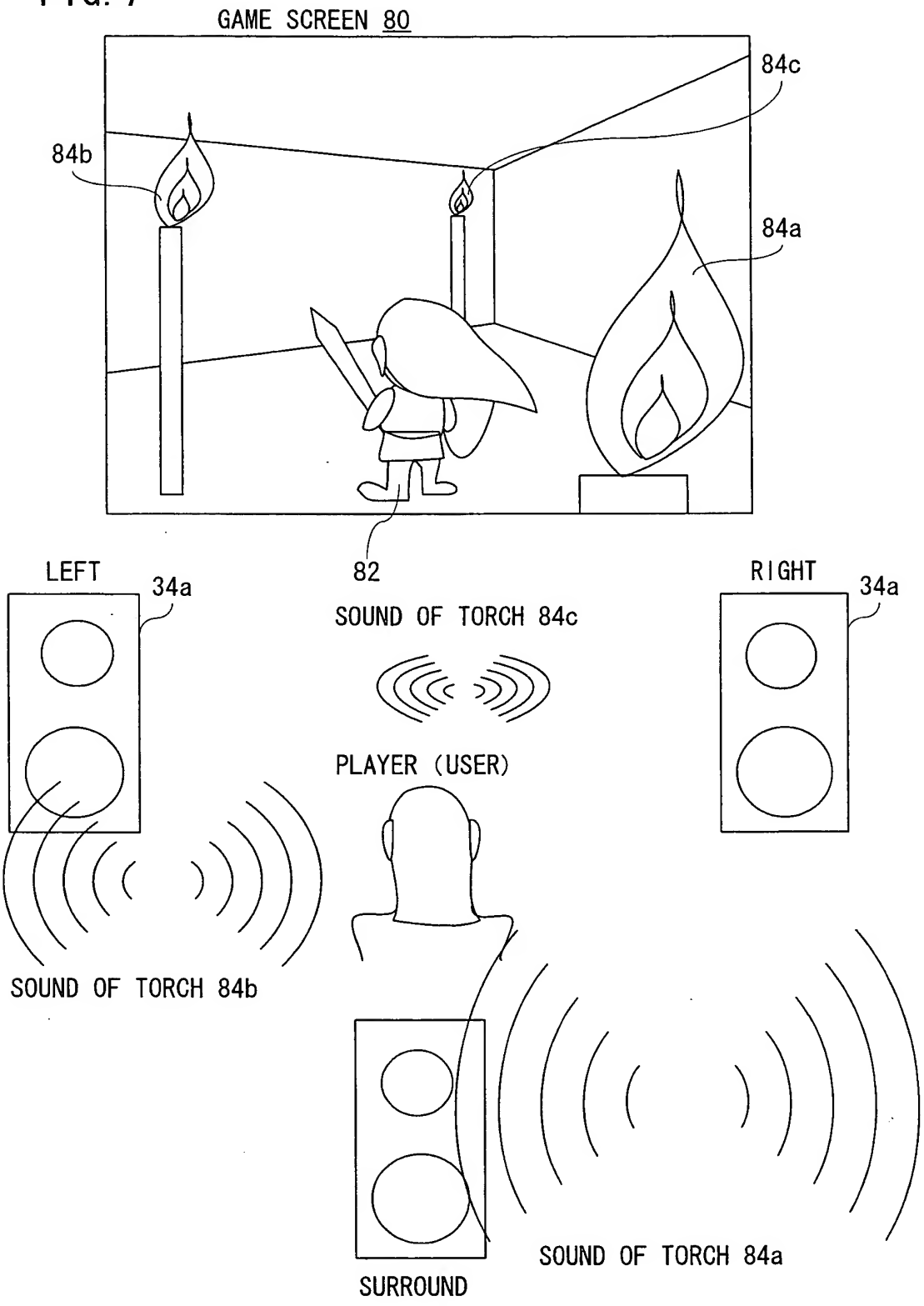

GAME SCREEN 80
84c
84b
84a
82
LEFT
34a
SOUND OF TORCH 84c
RIGHT
34a
PLAYER (USER)
SOUND OF TORCH 84b
SOUND OF TORCH 84a
SURROUND

FIG. 8

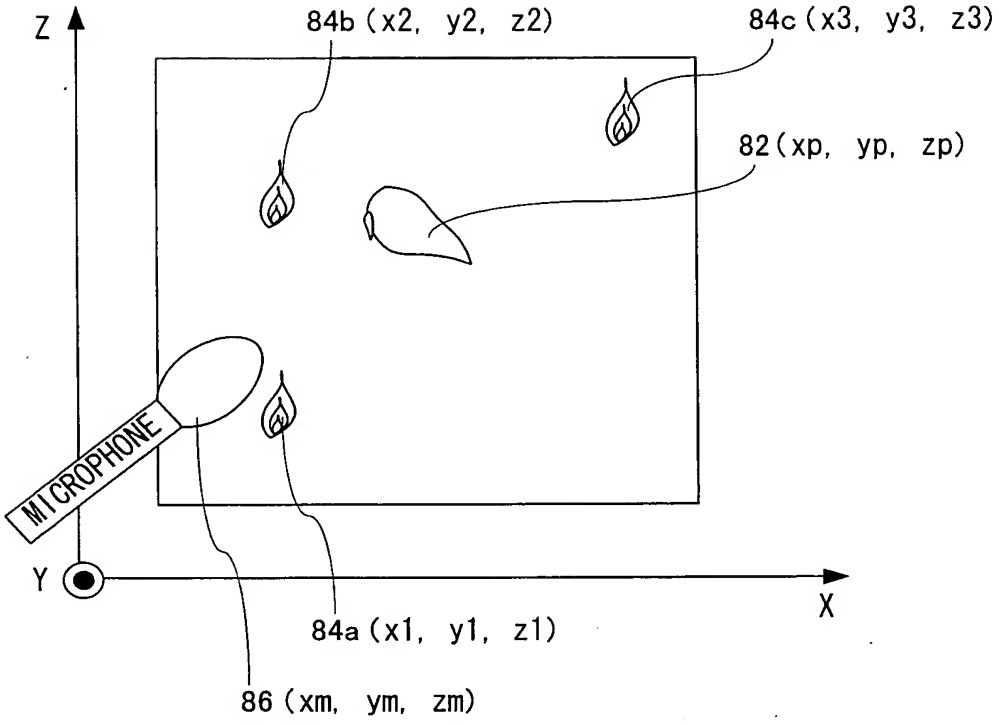

Z
84b (x2, y2, z2)
84c (x3, y3, z3)
82 (xp, yp, zp)
MICROPHONE
Y
X
84a (x1, y1, z1)
86 (xm, ym, zm)

FIG. 9

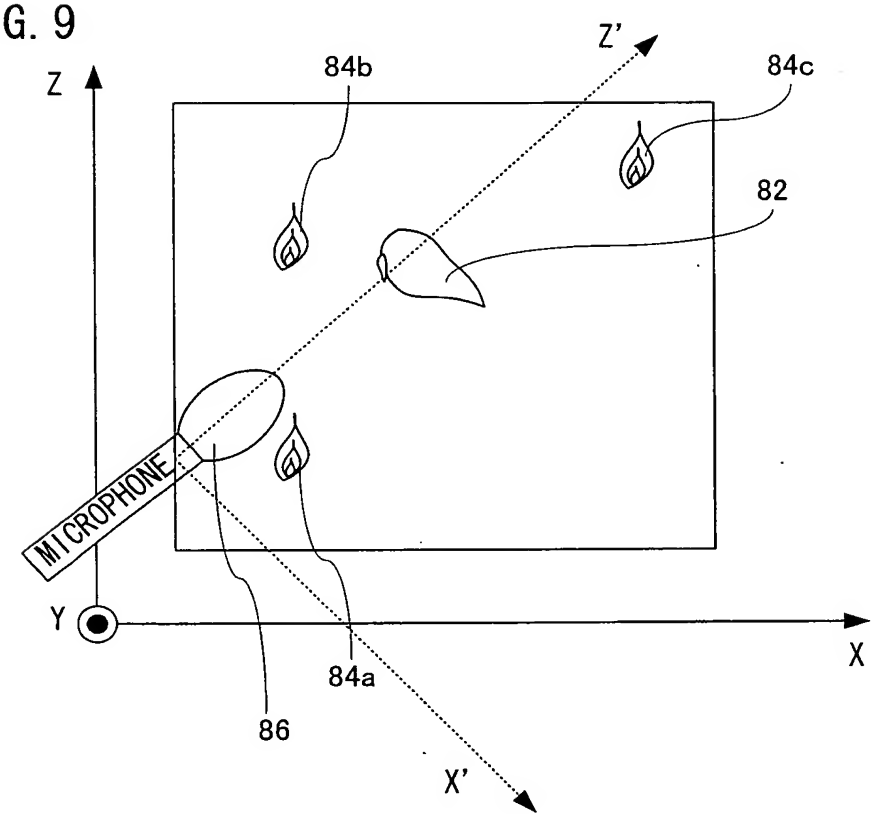

Z'
Z
84b
84c
82
MICROPHONE
Y
X
84a
86
X'

FIG. 10

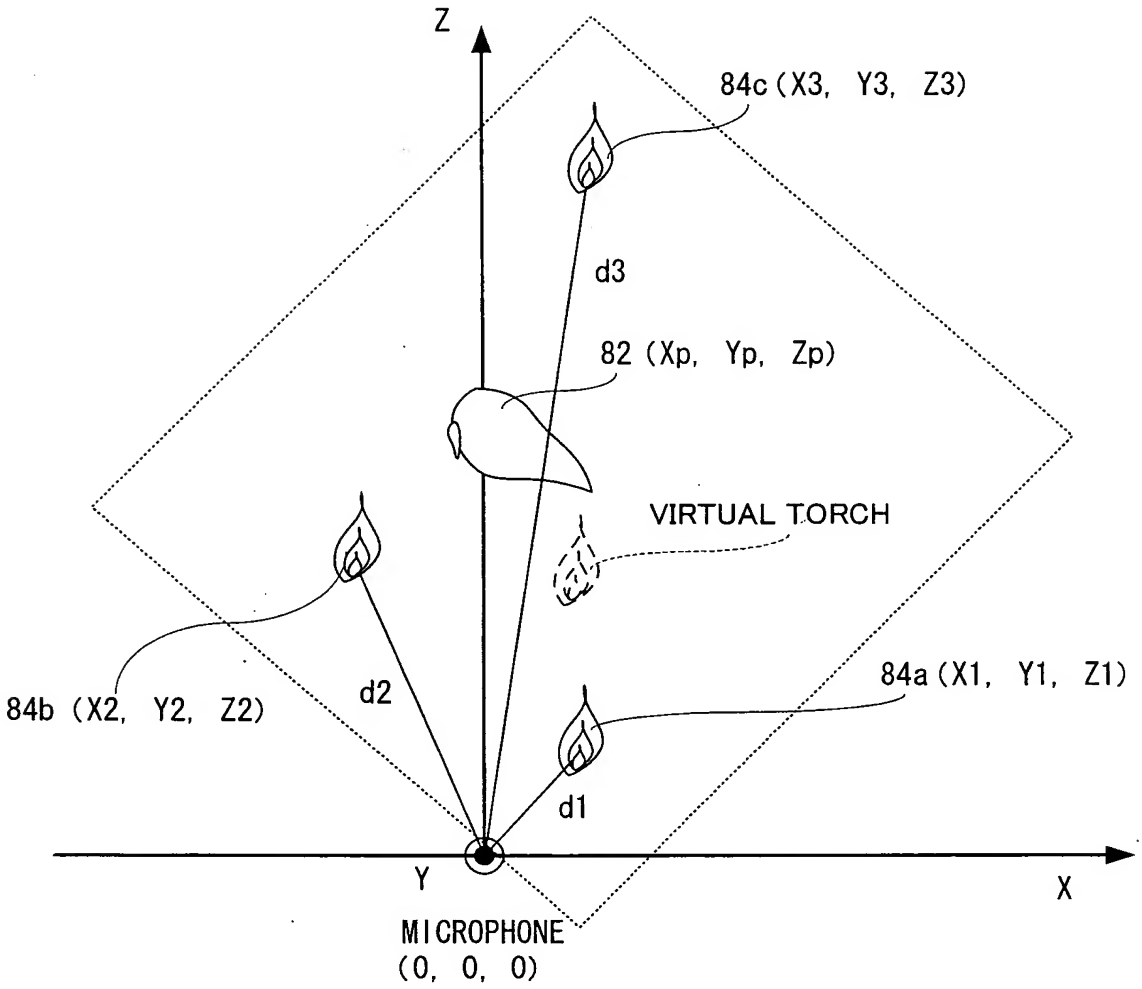

Z
84c (X3, Y3, Z3)
d3
82 (Xp, Yp, Zp)
VIRTUAL TORCH
84b (X2, Y2, Z2)
d2
84a (X1, Y1, Z1)
d1
Y
X
MICROPHONE
(0, 0, 0)

FIG. 11

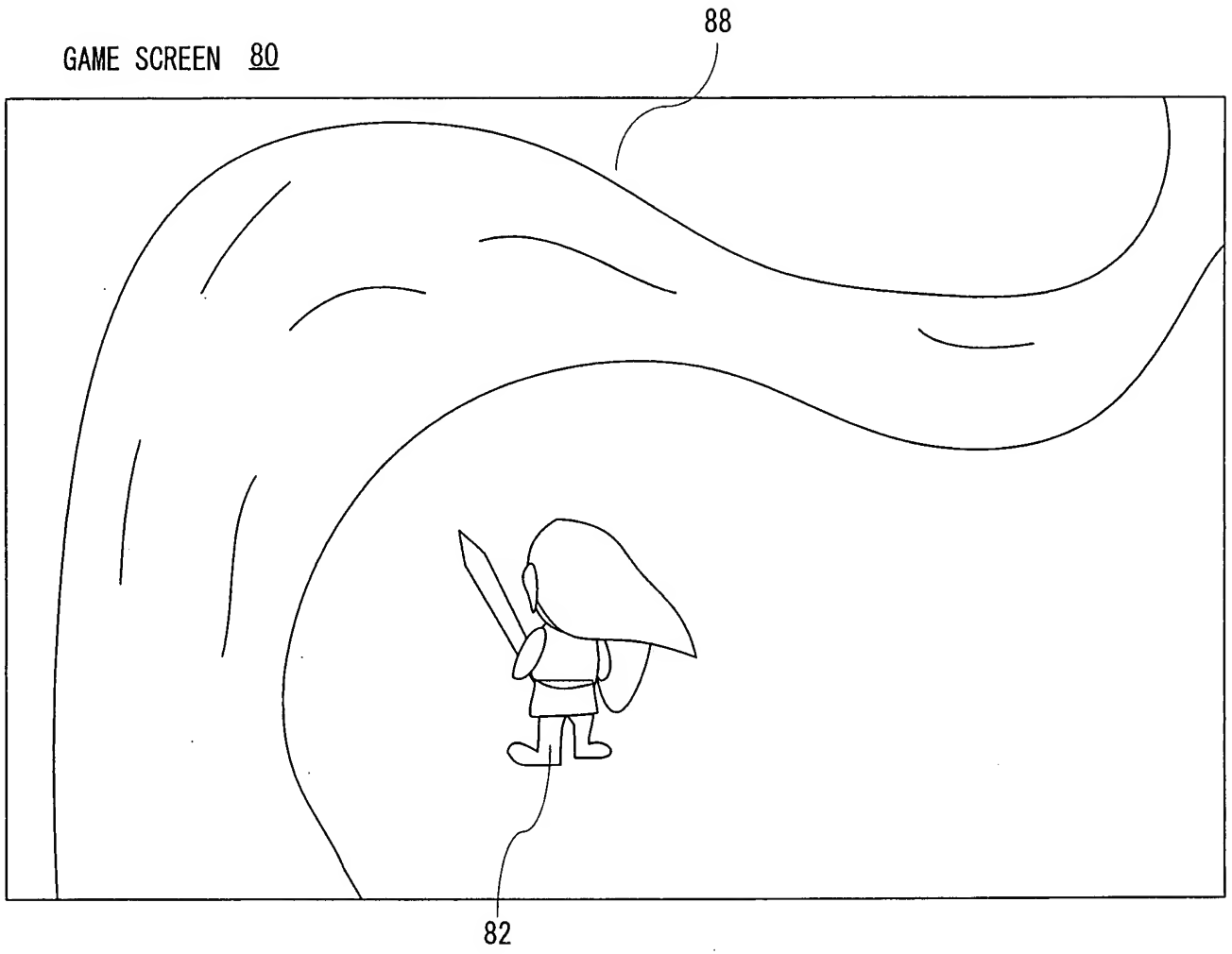


FIG. 12

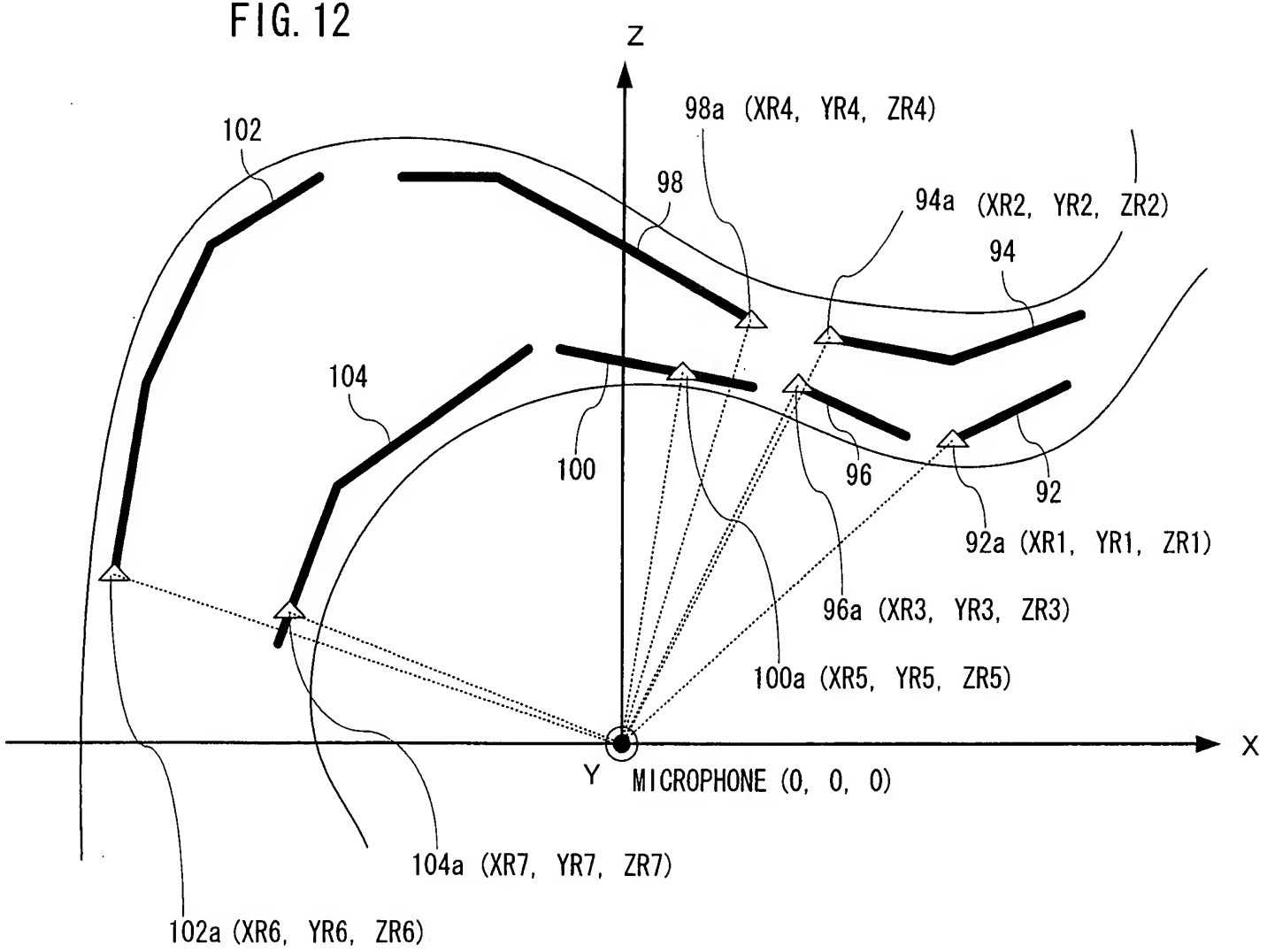

Z
98a (XR4, YR4, ZR4)
102
98
94a (XR2, YR2, ZR2)
94
104
100
96
92
92a (XR1, YR1, ZR1)
96a (XR3, YR3, ZR3)
100a (XR5, YR5, ZR5)
X
Y
MICROPHONE (0, 0, 0)
104a (XR7, YR7, ZR7)
102a (XR6, YR6, ZR6)

FIG. 13

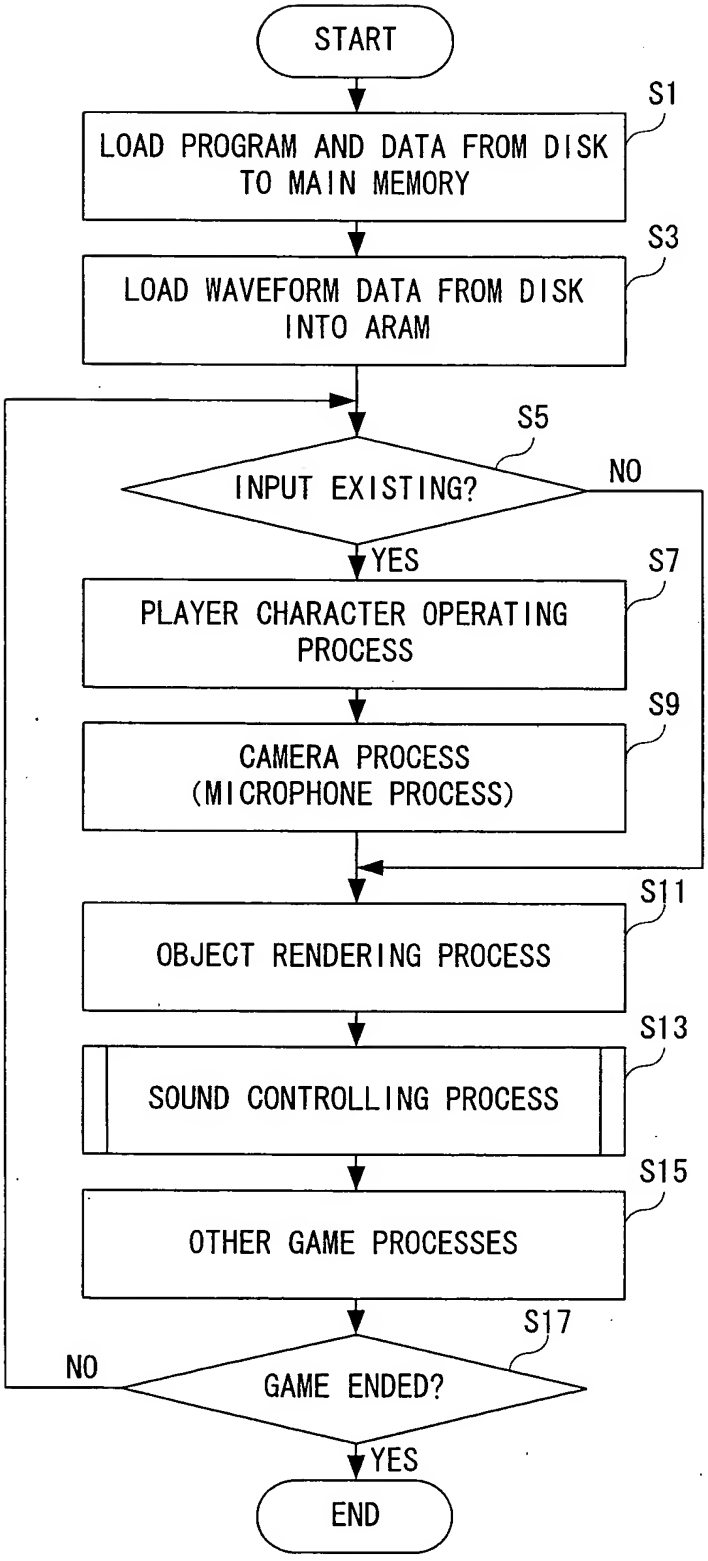

START
S1
LOAD PROGRAM AND DATA FROM DISK TO MAIN MEMORY
S3
LOAD WAVEFORM DATA FROM DISK INTO ARAM
S5
INPUT EXISTING?
NO
YES
S7
PLAYER CHARACTER OPERATING PROCESS
S9
CAMERA PROCESS (MICROPHONE PROCESS)
S11
OBJECT RENDERING PROCESS
S13
SOUND CONTROLLING PROCESS
S15
OTHER GAME PROCESSES
S17
GAME ENDED?
NO
YES
END

FIG. 14

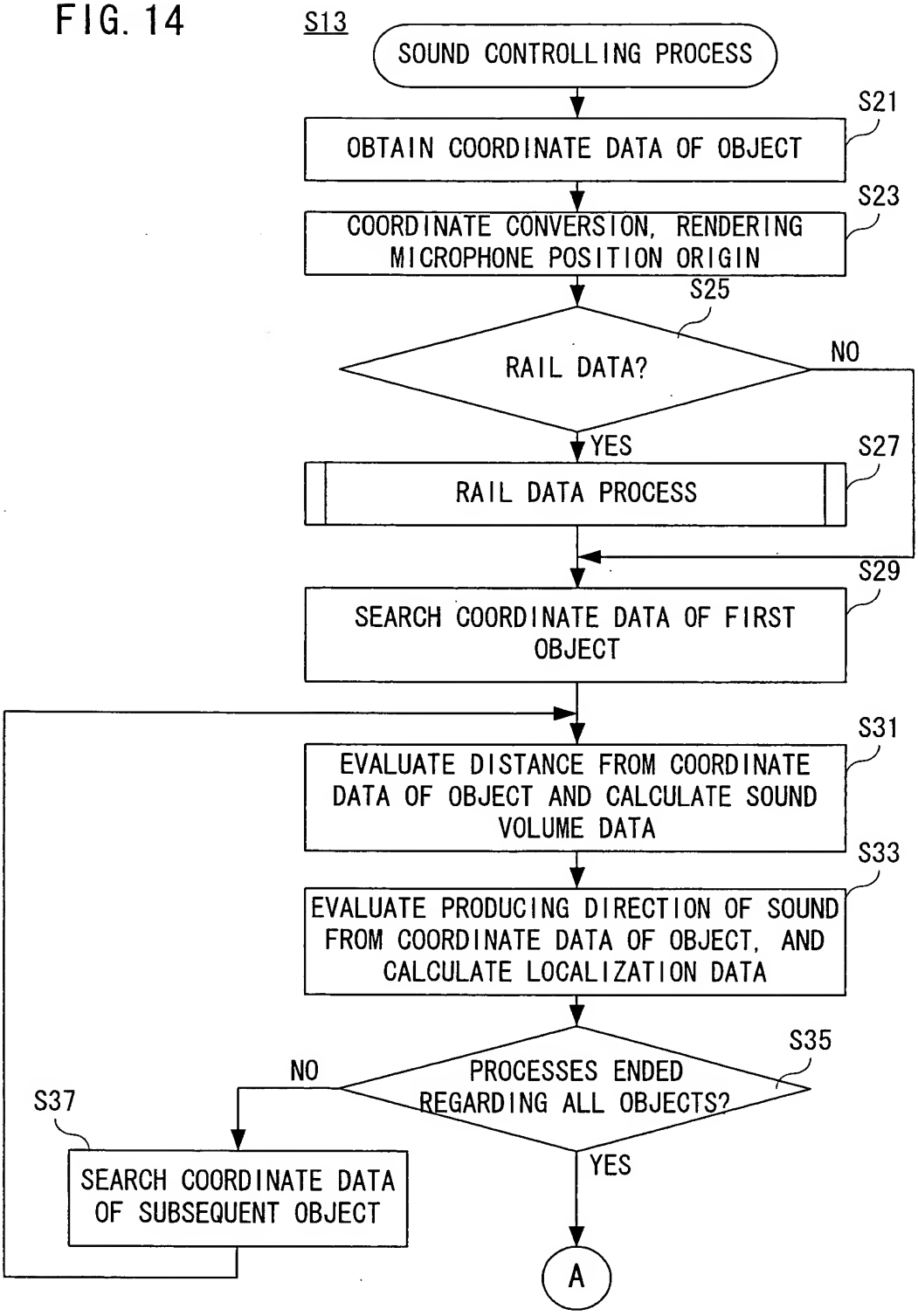

S13
SOUND CONTROLLING PROCESS
S21
OBTAIN COORDINATE DATA OF OBJECT
S23
COORDINATE CONVERSION, RENDERING MICROPHONE POSITION ORIGIN
S25
RAIL DATA?
NO
YES
S27
RAIL DATA PROCESS
S29
SEARCH COORDINATE DATA OF FIRST OBJECT
S31
EVALUATE DISTANCE FROM COORDINATE DATA OF OBJECT AND CALCULATE SOUND VOLUME DATA
S33
EVALUATE PRODUCING DIRECTION OF SOUND FROM COORDINATE DATA OF OBJECT, AND CALCULATE LOCALIZATION DATA
S35
PROCESSES ENDED REGARDING ALL OBJECTS?
NO
YES
S37
SEARCH COORDINATE DATA OF SUBSEQUENT OBJECT
A

FIG. 15

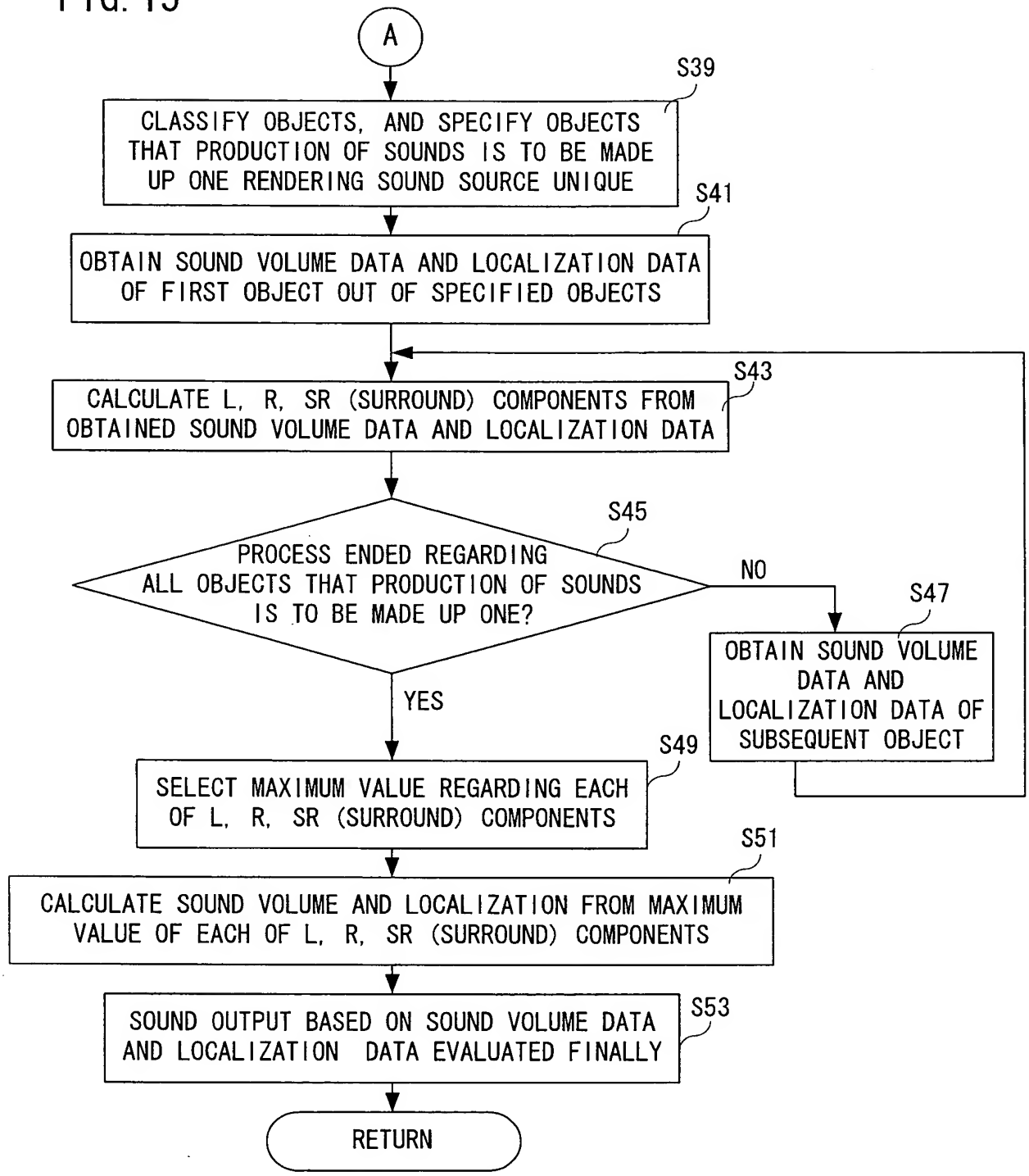
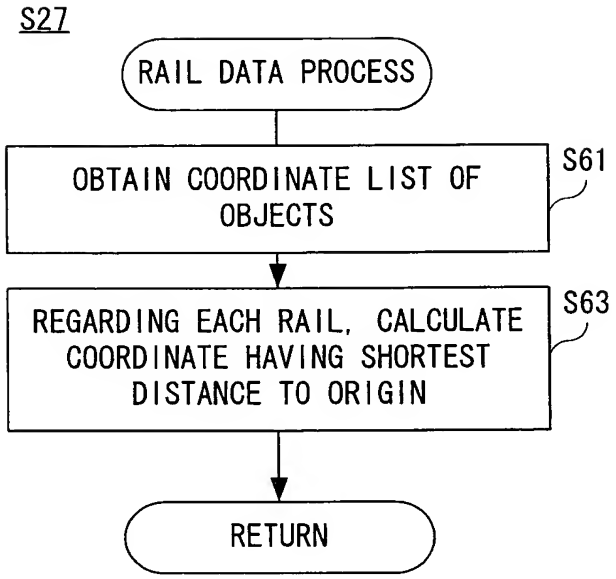

A
S39
CLASSIFY OBJECTS, AND SPECIFY OBJECTS THAT PRODUCTION OF SOUNDS IS TO BE MADE UP ONE RENDERING SOUND SOURCE UNIQUE
S41
OBTAIN SOUND VOLUME DATA AND LOCALIZATION DATA OF FIRST OBJECT OUT OF SPECIFIED OBJECTS
S43
CALCULATE L, R, SR (SURROUND) COMPONENTS FROM OBTAINED SOUND VOLUME DATA AND LOCALIZATION DATA
S45
PROCESS ENDED REGARDING ALL OBJECTS THAT PRODUCTION OF SOUNDS IS TO BE MADE UP ONE?
NO
S47
OBTAIN SOUND VOLUME DATA AND LOCALIZATION DATA OF SUBSEQUENT OBJECT
YES
S49
SELECT MAXIMUM VALUE REGARDING EACH OF L, R, SR (SURROUND) COMPONENTS
S51
CALCULATE SOUND VOLUME AND LOCALIZATION FROM MAXIMUM VALUE OF EACH OF L, R, SR (SURROUND) COMPONENTS
S53
SOUND OUTPUT BASED ON SOUND VOLUME DATA AND LOCALIZATION DATA EVALUATED FINALLY
RETURN

FIG. 16


S27
RAIL DATA PROCESS
OBTAIN COORDINATE LIST OF OBJECTS
S61
REGARDING EACH RAIL, CALCULATE COORDINATE HAVING SHORTEST DISTANCE TO ORIGIN
S63
RETURN